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RP-001-001-1

OFFICE OF MANNED SPACE FLIGHT

APOLLO PROGRAM

REQUIREMENTS FOR ENVIRONMENTAL DATA IN SUPPORT OF THE APOLLO PROGRAM (U)

Issue IV

FEBRUARY 9, 1966

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declassified after 12 years

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON, D.C. 20546

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OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA GEN. REG. NO. 27

5010-107 [redacted]

UNITED STATES GOVERNMENT

National Aeronautics and Space Administration

Memorandum [redacted]

TO : S/Associate Administrator for Space Science and Applications

DATE: FEB 9 1966

FROM : M/Associate Administrator for Manned Space Flight

[redacted]

SUBJECT: Requirements for Environmental Data in Support of the Apollo Program (U) - Issue IV, RP-001-001-1 (Confidential)

The attached document "Requirements for Environmental Data in Support of the Apollo Program (U) - Issue IV," RP-001-001-1 (Confidential), replaces "Requirements for Data in Support of Project Apollo (U) - Issue III" (Confidential) transmitted to you on February 28, 1964. The document lists the environmental data which must be obtained to support the Apollo Program. It is anticipated that these data can be furnished by OSSA and OART. This document is also being sent to the Associate Administrator for Advanced Research Technology.

While some revisions have been made in the fundamental data requirements, this issue in addition sets forth procedures whereby the required environmental data and necessary supporting information can be furnished more effectively to the Apollo Program. Details on the nature and schedule of the response requested are included in the document.

To facilitate the work called for by the document, I suggest that one official in each office (OMSF, OART, OSSA) be designated to be responsible for coordination. Upon your concurrence, I request that the designation of the OSSA official be sent to the Apollo Program Director, Major General S. C. Phillips, at an early date so that contact may be established with the OMSF coordinator, Dr. L. Reiffel, MA.

As called for in the document, I also propose that the procedure for registering agreement on supporting programs be implemented. The official authorized to act for OMSF is Major General S. C. Phillips.

George E. Mueller

Enclosure
"Requirements for Environmental Data in Support of the Apollo Program (U) - Issue IV," RP-001-001-1 (Confidential)

NOTICE — THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

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[redacted]

U[redacted]from
[redacted]

[redacted]

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RP-001-001-1
Apollo Program
February 9, 1966

REQUIREMENTS FOR ENVIRONMENTAL DATA IN SUPPORT OF THE APOLLO PROGRAM (U)

Issue IV

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Dated February 9, 1966

LIST OF EFFECTIVE PAGES

The effective pages comprising this document are listed below by date. The dates shown on individual pages should agree with the dates shown on this list. Effective pages should be inserted and the replaced pages destroyed.

Page Number	Date
All Pages	February 9, 1966

TABLE OF CONTENTS February 9, 1966

Pages 5 through 19, inclusive, are [redacted]L. All other pages are UNCLASSIFIED.

February 9, 1966

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to define environmental data needed to support the Apollo program.

1.2 Scope

This document lists the principal environmental hazards to Apollo. It identifies the environmental data required to overcome or avoid these hazards. It classifies the required data as critical or supporting. Reporting procedures are defined as to content and schedule. Communication channels are established both by establishing reporting procedures and by formalizing liaison through the designation of a single official in each office responsible for overall coordination. Provision for registering agreement on supporting programs is made.

1.3 Background

The design, performance, and test requirements for the Apollo program are delineated in the Apollo Program Specification.* The standard environmental data for this

Program Document SE 005-001-1, May 1965 specification are contained in the Program Document, Natural Environment and Physical Standards for the Apollo Program which contains current best estimates of the environment the system will encounter. Since some of these estimates are based on insufficient data, conformity with the environmental document does not always avoid the possibility of undue hazard to the mission with the consequence of program delay, or overly conservative design. Recognizing this fact, the Office of Manned Space Flight in this document identifies certain environmental data as required within a certain time frame if the goals of the Apollo program are to be achieved expeditiously and with high confidence.

1.4 Definitions

NECESSARY DATA

The environmental data of a class or kind sufficient to the needs of the Apollo Program. (When the presently available data are not sufficient, additional data are "required".)

REQUIRED DATA

Environmental data which are not satisfactorily known and which must be obtained. The required data are divided into two categories in order of decreasing priority, "Critical Data" and "Supporting Data":

Critical Data

Critical Data are needed because existing data are insufficient to guarantee the adequacy of existing design and

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*Program Document M-D E 8020.008B (SE 015-001-1), April 1965 mission planning. The data are critical if the attendant result of their insufficiency could have unfavorable program impact. The data requested are in general engineering data, and are directly applicable to environmental models.

Supporting Data

Supporting data may (1) be "scientific" data contributing to a better understanding of the environment and therefore increasing the usefulness of critical data; or (2) be engineering data of lesser impact, leading to improvement in design efficiency and operation.

SUPPORTING PROGRAM

As used in this document a supporting program is an effort which if successful will provide data requested. It may consist of all or a portion of the experiments on a series of space flights or on a single space flight, or of only a single research contract. It is ordinarily an effort of such scope that only a single investigator or a small number of investigators is associated with it.

1.5 Related Documents

a. Natural Environment and Physical Standards for the Apollo Program, M-D E 8020.008B (SE 015-001-1), April 1965.

b. Apollo Program Specification, SE 005-001-1, May 1965 (confidential).

c. Apollo Program Development Plan, January 1965 ~~(confidential).~~

1.6 Revision and Change

This document will be revised and reissued annually. This document will be amended and updated as a result of the certification procedures stated in 4.3. Other suggested changes should be addressed to the Apollo Program Director, OMSF.

2.0 ENVIRONMENTS

2.1 Lunar Surface Environment

2.1.1 Introduction (Definitions - Apollo Interactions - Hazards)

The Apollo spacecraft interacts with the lunar surface indirectly for navigational fixes, and directly at touchdown. The safety of Apollo LEM during the touchdown operation is affected by the characteristics of the surface with which it interacts. The interaction occurs through the radar beams, through the legs of the vehicle and through the rocket exhaust. Exhaust effects may modify topography or impair visual and radar contact with the surface during approach. Potential hazards which have been envisaged include: bottoming or toppling of the vehicle, catastrophic sinkage or collapse of the surface, and reactions due to special surface properties, e.g., unexpected chemical or electrostatic activity.

2.1.2 Required Data

This paragraph summarizes the required critical data which are discussed further in 2.1.4. The basis for the determination of required data, a discussion of the necessary data and the extent to which available data are sufficient, is given in 2.1.3.

REQUIRED DATA (Critical)

a. Bearing Strength

b. Topography

c. Jet Erosion

d. Site Location

2.1.3 Effects of the Lunar Surface Environment

2.1.3.1 Necessary Data

Prior to a manned landing, at least one area of the moon will have been accepted as an Apollo landing site. Acceptance will imply that the probability of success for a mission directed to this area and the probability of crew safety attributable to interaction with the lunar surface are high. High confidence is desirable. The necessary data include the locations and characteristics of one or more such sites. The areas must fall within the Apollo zone of primary interest, bounded by 5° north and 5° south latitude and within 45° west and 45° east longitude.

The size of an Apollo landing site is related to the LEM C.E.P., and thus depends on the return from the unmanned program including, particularly, the emplacement of landing aids. Given only a set of earth-based landmarks, the site has an area of 10 km^2. If a highly reliable marker is left on the surface, the area may be as small as 0.3 km^2. With suitable approach photography, some intermediate size will result.

An Apollo landing site is "acceptable" if it is determined by survey to be 95% safe with high confidence. It may be assumed that the astronauts will use the maneuvering capability of the LEM to achieve the 99% probability of safe landing required by the Apollo Program Specification, given a surface only 95% safe. A surface surveyed to a lower confidence level may also be satisfactory if the surface appears very safe. The development of detailed site surveying plans will be contingent upon the results of the early unmanned missions.

2.1.3.2 Status: Current Information

Data on the lunar surface adequate for the evaluation of

Apollo landing sites are lacking. Earth-based photometric, infrared, microwave, and radar data suggest a variable porous insulating surface layer of unknown depth. The Ranger pictures give topographic data over very small areas. These data suggest that the OMSF "Lunar Model at Touchdown Point"* is sufficiently conservative with regard to small scale topography, and that topographically suitable sites will not be difficult to find. There are no direct data on surface bearing strength.

2.1.4 Required Data (In order of priority)

Data required for the evaluation of Apollo landing sites are listed below in priority order. The requirements are derived from the OMSF lunar model* and from the statements above concerning the necessity of obtaining at least one acceptable site prior to a manned landing.

2.1.4.1 Critical Data

The following information is critically needed:

(a) Bearing Strength - The response of the surface to static and dynamic loads must be known. This includes the variation in response with depth of penetration - until either a sufficient strength or a 50 cm depth is reached. The measuring instrumentation must be such that it is possible to extrapolate the returned data to loads transmitted by a pad 1 meter in diameter. In the static case the load is 1 psi. In the dynamic case the load is 12 psi, applied at a maximum vertical velocity component of 3.1 meters (10 feet) per second a maximum horizontal velocity component of 1.2 meters (4 feet) per second.

(b) Topography - The following data are needed for the topographic certification of Apollo landing sites:

(1) The sizes and locations of small-scale relief features with vertical dimensions of 1/2 meter and greater.

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*Natural Environment & Physical Standards for the Apollo Program, Program Document M-D E 8020.008B, SE 015-001-1, April 1965, paragraph 5.8.

(2) The magnitudes and distributions of local slopes greater than 5° over areas larger than a 10 meter radius circle.

(c) Jet Erosion - It is conceivable that the lunar surface strength is more than sufficient to support landing loads yet the rocket exhaust is capable of rapidly eroding this surface. Information is critically needed about surface characteristics which would favor such erosion.

In order to evaluate the potential dust hazard, it is necessary to determine a definitive set of the properties listed below:

(1) Soil particle sizes and densities

(2) Soil cohesion

(3) Angle of internal friction

(4) Soil shear strength

(5) Lunar soil reaction to a properly scaled gas impingement test.

If the lunar soil is erodable under exhaust gas impingement, the thickness and variability of the erodable layer will have to be determined.

It should be noted that the above information will also be very helpful in understanding the formative processes. This knowledge is essential if confident statements are to be made about soil characteristics over large areas on the basis of a few point measurements.

(d) Site Location - Data and/or physical assistance for reducing the Apollo C.E.P. are required. The use of a marker in approach is covered above, under "size of site," paragraph 2.1.3.1. The following concerns data needed for orbital navigation.

The site must be identifiable from a CM orbiting at 80 nautical miles altitude. The location of the center of the site should be known in relation to at least one lunar sighting mark or emplaced manmade device to an accuracy of 100 m or 10% of the site diameter whichever is smaller.

The sighting mark(s) should be located to an accuracy of a few hundred meters relative to one or more major terrain features visible from earth.

2.1.4.2 Supporting Data

The following information is desirable but not critical:

(a) Guaranteeing the homogeneity of bearing strength across a site is a major task; reasonable confidence will be obtained only by joining the data with understanding of the lunar surface acquired from other measurements. In particular correlation of observed properties with broad scale data from earth-based visible, infrared, radar, and other data may be invaluable.

Lunar experiments which aid in the calibration of earth-based experiments - as evaluations of dielectric constant and conductivity for the radar - could increase the usefulness of the latter. Lunar radar reflectivity properties would be of use in LEM landing radar studies.

(b) Additionally, a number of "landmarks" for backup orbital determination are desirable. Landmark requirements are under study. It appears that accuracies between 500 and 1,000 meters are required if the landmarks are to be useful. The following are intended for preliminary guidance.

(1) Accuracies better than 500 meters are not helpful; these accuracies are attainable in the central regions, at least, by earth-based techniques.

(2) The need is for "control positions" and the appearance (from 80 nm) of the landmarks.

(3) For each CM orbital track at least 5 lighted landmarks located within 2° of the ground track are desired. The spacing of the landmarks is optimally 30° and should not be less than 9°.

2.2 Meteoroid Environment

2.2.1 Introduction

During the manned lunar mission, the Apollo spacecraft will sweep out an exposure (area-time product) of about 10^8 m^2 sec. The significant flux of meteoroids is taken as 10^{-9} to 10^{-11} m^{-2} sec^{-1}; i.e., the design particles are determined from this flux. Similarly, the astronaut may accumulate an exposure of 10^5 m^2 sec. The data concerning the flux range 10^{-6} to 10^{-11} m^{-2} sec^{-1} are "critical". In addition there may be a potential hazard from secondary ejecta on the lunar surface.

A meteoroid encounter results in hazard to the mission if a vital external component is damaged or if puncture of the spacecraft walls* allows debris to damage a vital internal component.

2.2.2 Required Data

This paragraph summarizes the required critical data which are discussed further in 2.2.4. The basis for the determination of required data, a discussion of the necessary data and the extent to which available data are sufficient, is given in 2.2.3.

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*The SM wall largely comprises two .016" aluminum sheets separated by a 1" deep aluminum honeycomb. A third "curtain" wall (nominally .01" aluminum) may back up this structure in much of the area at a minimum spacing about 1". The LEM walls are double; the outer is .008" aluminum, the inner at least that, but ranging to more than .025" in various areas. Spacing is typically 2".

REQUIRED DATA (Critical)

(a) Improved knowledge of the properties of meteoroids in the flux range of interest; flight test of meteoroid bumper.

(b) Reliable scaling laws for impact processes on complex structures at meteoroid velocities.

2.2.3 Effects of the Meteoroid Environment

In order to protect the spacecraft and astronaut from meteoroids it may be necessary to add mass to the spacecraft and spacesuit over that otherwise required. To insure mission success and crew safety with minimum weight penalty, accurate knowledge of the probability of suffering a meteoroid penetration is necessary.

2.2.3.1 Necessary Data

The following information about the meteoroid environment is necessary.

(a) Properties of meteoroids in the range of interest (approximately 10^{-6} to 10^{-11} m^{-2} sec^{-1} in flux);

(b) Physical structure of meteoroids (density and geometric shape are of primary importance, chemical composition and mechanical strength are of secondary importance for the determination of impact properties);

(c) Bumper performance of multiple wall structures;

(d) Definition of the flux distribution in space and time (showers) to facilitate improvements in design efficiency and operational scheduling.

2.2.3.2 Current Status of Necessary Data

The current status of information on the meteoroid hazard is as follows:

(a) The flux-mass distribution is uncertain by an order of magnitude in the range of interest. The velocity distribution is poorly defined.

(b) Typical meteoroids appear to have low density and appear to be fragile; they are described as dust balls. The penetrating properties of such meteoroid structures cannot readily be determined. Depending on the detailed structure of a projectile its capability of penetrating a given target varies greatly.

(c) Hypervelocity impact measurements are generally limited to velocities lower than meteoroid velocities. No data are available on the impact of a dust ball. Information concerning normal impact on single wall and two sheet structures is nearly adequate. Information on the more complex structures and on the failure modes is inadequate.

(d) The puncture rate of small single-sheet structures in space (Explorer XVI and XXIII) is substantially lower than rates predicted using the current Apollo model. This greatly lowers confidence in the understanding of existing meteoroid information.

In summary, considerable uncertainty in estimates of the meteoroid hazard remains.

2.2.4 Required Data (In order of priority)

2.2.4.1 Critical Data

The following information is critically needed:

(a) Improved knowledge of the properties of meteoroids in the flux range of interest (flux: 10^{-6} to 10^{-11} m^{-2} sec^{-1});

(The parameters measured should be directly pertinent to spacecraft damage. In particular, flight test of a meteoroid bumper configuration is strongly urged. An outer sheet thickness comparable with the LEM (.008" aluminum) or SM (.016" aluminum) is desirable).

(b) Ground-based hypervelocity impact studies directed at the ballistic limit and failure modes of complex structures comparable with the SM and LEM. (Experimental and theoretical studies shall be closely combined if these data are to be applicable to meteoroid impacts).

2.2.4.2 Supporting Data

The following information is desirable but not critical

(a) Increased knowledge of the properties of meteoroids outside the flux range of direct influence;

(Meteoroid fluxes adjacent to the range of design interest, particularly if damage to complex structures is evaluated, or if the characterization of the particles is complete - as by simultaneous measurement of mass, velocity and density, etc. -would be extremely valuable).

(b) Increased knowledge of hypervelocity impact phenomena not directly applicable to Apollo structures but otherwise increasing our understanding of the interaction of high velocity (10-70 km/sec) projectiles with materials;

(c) Studies of the time variation of the meteoroid flux in the critical flux-mass range (meteoroid shower studies);

(d) Design confirmation measurements on meteoroid erosion, the space variation of meteoroid flux, and on lunar secondary ejecta.

The supporting data listed in subparagraphs (a) and (b) above could yield a broad base of understanding within which critical data could be more readily interpreted and extended.

The supporting data listed in subparagraphs (c) and (d) above could improve the efficiency of design or of flight operations.

2.3 RADIATION ENVIRONMENT

2.3.1 Introduction

The Apollo spacecraft is subjected to radiation -- electromagnetic and corpuscular. The intensity is quite variable. The magnetic fields of the earth and of the solar system cause a marked spatial dependence of charged particle intensities; solar disturbances cause a marked time dependence. Three phenomena are considered: solar cosmic ray events, trapped radiation belts, and galactic cosmic rays.

The Apollo spacecraft passes rapidly through the trapped radiation belt, and the dose received is small providing the configuration of the belts is not grossly changed. The galactic cosmic ray intensity is small enough to be ignored in a two-week mission. Thus, the radiation hazard to Apollo is primarily the result of severe solar cosmic ray events. Such events last several days but occur infrequently.

2.3.2 Required Data

This paragraph summarizes the required critical data which are discussed further in 2.3.4. The basis for the determination of required data, a discussion of the necessary data and the extent to which the available data are sufficient, is given in 2.3.3.

REQUIRED DATA (Critical)

(a) Direct measurement of cosmic ray events; intensity, spectrum and composition should be known as a function of time.

(b) Improved understanding of the biological effects of solar cosmic rays.

(c) Indirect measurements of solar cosmic rays to aid in comparing the severity of the 20th solar cycle to that of the 19th.

2.3.3 Effects of the Radiation Environment

In general, radiation damage to the spacecraft systems is negligible compared with the effect on the astronauts. Mission success and crew safety may be affected if illness temporarily incapacitates the astronaut at a crucial point in the mission, and this consideration determines the maximum permissible emergency dose.

Since the shielding offered by the LEM and by the spacesuit is small relative to the CM*, any radiation dose received during the lunar surface part of the mission is likely to dominate the total. As a result there is considerable emphasis on abort modes which shorten or eliminate the lunar stay. The radiation hazard affects primarily mission success rather than crew safety.

2.3.3.1 Necessary Data

By the time of the first manned lunar mission the following data should be available to the Apollo program:

Solar Cosmic Ray Events

(1) A tabular survey of the properties in cislunar space of solar cosmic ray events is necessary. The properties observed should include composition, intensity, and spectrum as a function of time. This tabulation, together with data from earlier solar cycles, will be used to test estimates of mission safety, and to perfect plans for the operational avoidance of hazard.

(2) Mission success will suffer because of unnecessary aborts, unless a reliable warning scheme is developed. Ideally, such a scheme would give

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*LEM $\sim$ 0.15 gm/cm^2, suit $\sim$ 0.2 gm/cm^2, CM 10% of the solid angle 1.5 gm/cm^2, 90% very thick.

several hours warning of a severe event with high reliability for in-flight abort. Longterm warnings of lesser accuracy may also be useful. Data allowing a reliable warning system to be developed should be obtained.

2.3.3.2 Current Status of Necessary Data

(a) Solar Cosmic Ray Events

(1) Current solar cosmic ray tabulations include about 50 events, from the last (19th) solar cycle; only the years since 1960 are well covered by direct satellite measurement. Of the ground based data some (polar cap absorption) extend well back into the 18th cycle, but the calibration of this data is limited by our lack of knowledge of terrestrial magnetic field configuration during those events. The best warning systems now available combine optical and radio observations of the solar flare. The usefulness of warning is limited by the false alarm rate. Although studies indicate that improvement is likely, the false alarm rate at present is unacceptably high (two false for one true) before the arrival of solar cosmic rays. Event size can be predicted within a factor of three.

(2) Limited biological information exists for exposures to x-rays and neutrons. No sufficiently extensive studies have been made of proton and electron exposures.

2.3.4 <u>Required Data</u> (In order of priority)

2.3.4.1 Critical Data

The following data are critically needed:

(a) Direct measurement of cosmic ray events. Intensity, spectrum and composition should be known as a function of time. The capability of making satellite measurements characteristic of particle fluxes in cislunar space should be virtually continuous. "Severe" events, considered as those having integral intensities greater than 10^8 particles per square centimeter above a rigidity of 239 Mv (30 Mev energy), are of particular interest. For protons the energy range from 10-100 Mev is critical, and 1-300 Mev, of interest. It is important that estimates of the characteristics of each event be reported to MSF at the earliest possible time, so that they may be correlated with observations by the developmental warning system, and so that the significance of the event for radiation design models may be rapidly assessed.

(b) Improved understanding is needed on the effects of exposure of man to solar cosmic radiation. Investigations of the radiation damage processes would be very helpful. The parts of the body most sensitive to radiation should be identified. Variations in the sensitivity of men to radiation should be examined, as should means of ameliorating the effect of a given dose.

(c) Indirect measurements of solar cosmic rays, especially Polar Cap Absorption measurements and neutron monitor measurements are necessary to show whether or not the 20th solar cycle is comparable in severity to the 19th. Studies of the earth's magnetic field during the events should help increase the usefulness of the data as far as interpretation is concerned.

2.3.4.2. Supporting Data

The following data are desirable but not critical:

(a) Studies of those areas of solar physics related to the origin of solar cosmic rays and to their propagation through the interplanetary medium are significant. Measurements of ancillary flare phenomena, such as neutron, x-ray, and radio fluxes, are encouraged. The number of severe solar cosmic ray events will be much too small for statistical treatment; high confidence, either in design models or in warning systems will be gained only through understanding.

(b) Monitoring and tabulation of electron and proton fluxes in the trapped radiation belts;

(c) Evaluation of the interaction of radiation with spacecraft.

3.0 REPORTING

3.1 Environmental Data Reports

A summary listing of the subject matter of required data reports is given below. Amplifying information is found in the paragraph cited in parentheses after each subject report.

3.1.1 Critical Data

(a) Lunar Surface Environment

1. Bearing strength (2.1.4.1 (a))
2. Topography (2.1.4.1 (b))
3. Jet Erosion (2.1.4.1 (c))
4. Site Location (2.1.4.1 (d))

(b) Meteoroid Environment

1. Improved knowledge of the properties of meteoroids in the flux range of interest; (flux: 10^{-6} to 10^{-11} m^{-2} sec^{-1}) the measured parameters being directly pertinent to spacecraft damage. Flight test of meteoroid bumper. (2.2.4.1 (a))
2. Ground based studies of the ballistic limit and failure modes of complex structures. (2.2.4.1 (b))

(c) Radiation Environment

1. Direct measurement of solar cosmic ray events (2.3.4.1 (a))
2. Biological effect of such radiation (2.3.4.1 (b))
3. Indirect measurement of solar cosmic rays (2.3.4.1 (c))

3.1.2 Supporting Data

(a) Lunar Surface Environment

1. Supplementary earth-based observations (2.1.4.2 (a))

2. Landmarks for backup orbital determination (2.1.4.2 (b))

(b) Meteoroid Environment

1. Increased knowledge of the properties of meteoroids adjacent to the flux range interest, if damage to complex structures is measured, or if meteoroid characterization is complete. (2.2.4.2 (a))

2. Hypervelocity impact measurements increasing our understanding of the interaction of high velocity projectiles with materials (2.2.4.2 (b))

3. Time variation of the meteoroid flux in the critical flux-mass range (meteoroid shower studies) (2.2.4.2 (c))

4. Design confirmation measurements on meteoroid erosion, on the space variation of meteoroid flux, and on lunar secondary ejecta (2.2.4.2 (d))

(c) Radiation Environment

1. Origin and propagation of solar cosmic rays (including measurement of neutron, x-ray and radio fluxes) (2.3.4.2 (a))

2. Monitoring and tabulation of electron and proton fluxes in trapped belts (2.3.4.2 (b))

3. Evaluation of the interaction of radiation with spacecraft (2.3.4.2 (e))

4.0 IMPLEMENTING PROCEDURES

In order to assure that the required environmental data are available to the Apollo Program in the appropriate form, quantity and schedule, certain inter-office liaison and reporting procedures will be formalized by agreement between the offices concerned.

4.1 Liaison

In each office concerned (OMSF, OSSA, OART) a representative should be designated as the official responsible for coordinating all activities connected with Apollo environmental data support within his organization including the preparation and submission of reports. Monthly coordination meetings of these representatives should be held in addition to informal contacts as necessary.

4.1.1 Establishment

The Office of Manned Space Flight (Apollo Program) by separate correspondence will propose that these representatives be designated.

4.2 Reporting

The reports required by the Office of Manned Space Flight which are described in the following subparagraphs are:

(a) Supporting Programs Summary Report

(b) Supporting Program Report

(c) Data Report

4.2.1 Supporting Programs Summary Report

The Supporting Programs Summary Report lists the programs* which are proposed to be in support of Apollo requirements with a brief description of each.

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*See definition, page 3.

This report is requested within 4 weeks of the effective date of this document. The requirement for this report is annual.

4.2.2 Supporting Program Report

The Supporting Program Report is a comprehensive report which treats an individual program tentatively determined by MSF to be in support of Apollo requirements. The suggested content of this report is indicated by the format shown in Appendix A. This report is required within 8 weeks of the tentative determination by MSF that a program is in support. This tentative determination is communicated by separate correspondence from MSF subsequent to review by MSF of the Supporting Programs Summary Report.

Verification of the validity of a Supporting Program Report shall be made quarterly by letter. This report should be amended upon the occasion of a major change in program plan, schedule, or capability.

4.2.3 Data Report

The Data Report transmits environmental data produced by a supporting program. It responds to the requirements for data stated in Section 2 and listed in Section 3. It should be submitted quarterly and upon the occasion of the obtaining of significant new data. The specific content, format and schedule for individual Data Reports will be as agreed to in individual Supporting Program Certifications (Appendix B).

4.3 Certification

It is necessary to achieve and record inter-office agreement in the matter of Supporting Programs (including data reports). The method of recording these agreements is given below.

4.3.1 Supporting Programs

Upon the determination by MSF based on a review of a Supporting Program Report that a program is in support of Apollo requirements an agreement to that effect will be signed by designated officials of MSF and the appropriate recipient office. Each such agreement shall be appended to this document and will constitute a formal part thereof. These agreements shall be identified as Appendix B-1, B-2, B-3, and so on. This agreement shall contain the following:

(a) Program identification

(b) Program description

(c) Program schedule

(d) Mission assignments

(e) Data Report (content (including end-item description) and schedule)

These agreements shall be amended as required to be in accord with the appropriate valid Supporting Program Report.

February 9, 1966

5.0 APPENDICES

APPENDIX A

This appendix provides in outline form a suggested content of the Supporting Program Report described in paragraph 4.2.2 of the text. It indicates the organization of the report and the level of detail, both program and technical, which is desired. At the option of the respondent, portions of the report may be covered or amplified by attached references.

A-1 PROGRAM DESCRIPTION

A. Flight programs

(1) Schedule

(2) Mission assignments (objectives, profile, etc.)

(3) Spacecraft performance

(4) Spacecraft reliability

B. Ground-based programs

(1) Schedule of capability growth or of Apollo support investigations

(2) Objectives, etc.

(3) Supporting facilities and equipment

(a) Description

(b) Availability

A-2 INSTRUMENTS AND DATA REDUCTION

A. Apollo Support Instrument (for each)

(1) directly measured parameters: range, etc.

B. Data Analysis

(1) Organization

(2) Methods (including calibration of raw data and error analysis)

(3) Schedule

(4) End items

A-3 SUPPORT OF APOLLO

A. Program Strategy

Relation of data returned to Apollo required data; critical and supporting. How, and how much program will improve status.

B. Mission plans

Obtaining Data: Return of Apollo required data as a function of time

(1) Nominal

(2) Contingency planning: branch points in plan,

(3) Certitude of obtaining Apollo required data

C. Deliverable End Items

(1) Schedule of Data Return

(2) End Item Content

(a) Apollo Environmental data

(b) Uncertainties

(c) Associated program performance data

(d) Format

February 9, 1966

APPENDIX B

(outline)

SUPPORTING PROGRAM CERTIFICATION

B-1 Program Identification

B-2 Program Description

B-3 Program Schedule

B-4 Mission Assignments

B-5 Data Report

1. Content

   a. End item description

   b. Environmental data

   c. Uncertainties

2. Schedule

B-6 Agreement